International Society That Learn Journal

e-ISSN: 3023-8374

2025 | Volume 2 | Issue 2 Page 299-328

Uluslararası Öğrenen Toplum Dergisi

e-ISSN: 3023-8374

2025 | Cilt 2 | Sayı 2

Sayfa 299-328

The Pedagogical Differences Between Digital Natives and Digital Immigrants: The Role of AI-Enhanced Teaching Strategies

Dijital Yerliler ile Dijital Göçmenler Arasındaki Pedagojik Farklar: YZ Ile Güçlendirilmiş Öğretim Stratejilerinin Rolü

Lynn Stammers, **https://orcid.org/0000-0001-8637-983X**

Sheffield University, Education Faculty, Sheffield, United Kingdom, lynnstammers@gmail.com

Uploaded: 14.10.2025; **Revised**: 17.11.2025; **Accepted:** 21.11.2025; **Published:** 01.12.2025

Stammers, L. (2025). The Pedagogical Differences Between Digital Natives and Digital Immigrants: The Role of AI-Enhanced Teaching Strategies. *International Society that Learn Journal, 2*(2), 299-328. https://doi.org/10.64782/istlj.2252299-328

Abstract

This study examines the pedagogical differences between digital natives and digital immigrants in the context of artificial intelligence (AI) supported teaching strategies. Using mixed methods of research design, teachers' adoption processes of AI tools were analyzed through quantitative (questionnaire) and qualitative (interviews and classroom observations) data collection techniques. The findings show that digital natives adapt to AI-supported teaching methods faster, while digital immigrants struggle in this process due to lack of technical knowledge and pedagogical habits. AI tools have the potential to reduce teachers' workload, create individualized learning environments, and increase student achievement. However, for the effective integration of AI technologies, teacher training programs need to be strengthened, technical support mechanisms need to be established, and more comprehensive regulations on data privacy issues need to be made. The results of the study suggest that educational policies should be restructured in line with AI-supported pedagogical transformation.

Keywords: Digital natives, digital immigrants, artificial intelligence assisted instruction, educational technologies, individualized learning

Özet

Bu çalışma, yapay zekâ (YZ) destekli öğretim stratejileri bağlamında dijital yerliler ile dijital göçmenler arasındaki pedagojik farklılıkları incelemektedir. Karma araştırma tasarımı yöntemleri kullanılarak, öğretmenlerin yapay zekâ araçlarını benimseme süreçleri, nicel (anket) ve niteliksel (mülakatlar ve sınıf gözlemleri) veri toplama teknikleriyle analiz edildi. Bulgular, dijital yerlilerin yapay zekâ destekli öğretim yöntemlerine daha hızlı uyum sağladığını, dijital göçmenlerin ise teknik bilgi ve pedagojik alışkanlık eksikliği nedeniyle bu süreçte zorlandığını gösteriyor. Yapay zekâ araçları, öğretmenlerin iş yükünü azaltma, bireysel öğrenme ortamları oluşturma ve öğrenci başarısını artırma potansiyeline sahiptir. Ancak, yapay zekâ teknolojilerinin etkin entegrasyonu için öğretmen eğitim programlarının güçlendirilmesi, teknik destek mekanizmalarının kurulması ve veri gizliliği konularında daha kapsamlı düzenlemeler yapılması gerekmektedir. Çalışmanın sonuçları, eğitim politikalarının yapay zekâ destekli pedagojik dönüşüme uygun şekilde yeniden yapılandırılması gerektiğini öne sürmektedir.

Anahtar Kelimeler: Dijital yerliler, dijital göçmenler, yapay zekâ destekli eğitim, eğitim teknolojileri, bireyselleştirilmiş öğrenme

Stammers, L. (2025). The Pedagogical Differences Between Digital Natives and Digital Immigrants: The Role of AI-Enhanced Teaching Strategies. *International Society that Learn Journal, 2*(2), 299-328. https://doi.org/10.64782/istlj.2252299-328

Highlights

- AI tools enhance individualized learning and reduce teachers' workload.
- Digital immigrant teachers need stronger support for AI adoption.
- Teacher training and ethics are key to sustainable AI integration.

Introduction

The rapid development of educational technologies has transformed teaching processes and reshaped teachers' pedagogical approaches. Artificial intelligence (AI)-assisted teaching tools offer advantages such as creating individualized learning environments, providing automated assessment systems, and reducing teachers' workload (Zawacki-Richter et al., 2019). However, adaptation to these technologies is not homogeneous among teachers; individuals' age, familiarity with technology, and pedagogical habits are determining factors in this process (Eltahir, et. Al., 2024).

The concepts of digital natives and digital immigrants put forward by Marc Prensky (2001) show that teachers exhibit different attitudes in this technological transformation process. While digital natives, as individuals who have grown up with technology, can easily integrate AI-supported teaching tools into their pedagogical processes, digital immigrants are more attached to traditional teaching methods and experience lack of technical knowledge, pedagogical adaptation difficulties and time management problems when using AI tools (Guo, Dobson & Petrina, 2008; Flynn, 2021).

The aim of this study is to analyze how pedagogical differences between digital natives and digital immigrants are reflected in the adoption of AI-supported teaching tools. In this context, it focuses on the following questions:

1. How and to what extent do digital natives and digital immigrants use AI-supported teaching tools?
2. How does the impact of AI tools on teaching strategies differ between digital natives and digital immigrants?
3. What are the main factors preventing teachers from adopting AI technologies?
4. How can the sustainability of AI-supported pedagogical transformation in education be ensured?

This study aims to contribute at both theoretical and practical levels. Theoretically, it aims to address the pedagogical differences between digital natives and digital immigrants from the perspective of AI-based teaching strategies. In terms of practice, it aims to develop

e-ISSN: 3023-8374 © 2025 International Society that Learn Journal

strategies that support more effective integration of AI tools into teaching processes by providing concrete recommendations for teacher education and educational policies.

Literature Review

The use of artificial intelligence (AI) supported technologies in education transforms teaching processes and requires pedagogical adaptations (Zawacki-Richter et al., 2019). However, the process of teachers' adoption of these tools varies depending on factors such as age, familiarity with technology, and pedagogical habits (Eltahir, et. Al., 2024). What pedagogical differences between digital natives and digital immigrants are reflected in the use of AI-based teaching tools is an important research gap in the field of educational technologies.

Digital Natives and Digital Immigrants: Conceptual Framework

The concept of digital natives and digital immigrants provides an important framework for understanding differences in technological adaptation in education (Prensky, 2001). Digital natives, as individuals who grew up with technology, adapt quickly to AI-supported teaching tools, while digital immigrants are late adopters (Guo, Dobson & Petrina, 2008). However, recent studies show that this distinction is not always sharp and individual differences play a key role (Flynn, 2021).

For example, Margaryan & Littlejohn (2008) argue that digital natives do not have as advanced digital literacy as they are thought to have but only use certain digital platforms effectively. Similarly, Kolikant (2010) states that digital natives are not fully integrated into technology in terms of pedagogical adaptability and that teachers' digital skills may be limited in educational processes.

In contrast, Ng (2012) shows that digital migrants can use AI tools effectively when they receive appropriate training and guidance. It is emphasized that digital migrants can adapt to pedagogical transformation more successfully, especially when teacher training and mentoring support are provided (Al-Zyoud, 2020).

This research suggests that more empirical studies are needed to understand how pedagogical differences between digital natives and digital immigrants are reflected in AI-supported teaching processes.

Pedagogical Use of AI Tools and Differences between Digital Natives and Immigrants

AI-supported teaching tools are radically changing the lecturing processes of teachers.

These tools offer many advantages such as individualized learning, automated assessment systems, and data analytics-supported teaching (Chao, et. Al., 2021).

Digital natives can enrich their lessons with interactive teaching strategies and data-based feedback mechanisms by adopting AI tools faster (Zawacki-Richter et al., 2019). For example, Eltahir et. Al. (2024) show that AI-supported instructional materials increase student achievement and reduce teacher workload.

On the other hand, digital migrant teachers experience more difficulties in the process of adopting AI tools. Chagas Lopes and de Souza (2023) emphasize that digital migrants resist time management, lack of technical knowledge, and giving up habitual teaching practices in their pedagogical adaptation process. Motorina et. Al. (2025) state that AI tools can limit pedagogical flexibility and reduce teacher-student interaction.

These differences reveal the need for personalized technology training programs in education. Al-Zyoud (2020) suggests that applied teacher training programs should be developed for digital migrants to use AI tools more effectively.

Benefits and Challenges of AI-Assisted Instructional Tools

Artificial intelligence (AI) tools offer a variety of pedagogical opportunities that can significantly transform educational processes. One of the main advantages is individualized learning, as AI enables the creation of content that adapts to the individual levels and needs of students (Chao, et. al., 2021). Another key opportunity is automated assessment, allowing for the instant scoring of tests and assignments, thereby providing timely feedback, and enhancing the learning experience (Eltahir, et. Al., 2024). Moreover, AI-driven data analytics can support teachers through feedback mechanisms that analyze student errors and offer targeted recommendations for improvement (Motorina, et. Al., 2025). Additionally, reducing teacher workload is a significant benefit, as AI-supported tools help educators manage their time more efficiently and optimize lesson planning processes (Zawacki-Richter et al., 2019).

Despite these advantages, the integration of AI into education also presents several challenges. One major obstacle is the lack of technical knowledge and infrastructure necessary to effectively implement AI tools (Flynn, 2021). Furthermore, there are pedagogical integration challenges, as not all types of courses are suitable for AI-assisted instruction (Ng, 2012). Concerns regarding data privacy and security also arise, particularly related to the ethical handling of student information by AI systems (Bennis, 2023). Lastly, resistance to change and time management issues hinder the widespread adoption of AI in education, as educators often struggle to find sufficient time to learn and integrate AI-based tools into their

teaching practices (Chagas Lopes & de Souza, 2023).

These factors suggest that continuous training and mentoring programs for teachers should be developed for the successful use of AI-supported teaching tools in education (Al-Zyoud, 2020).

Conclusion and Research Gaps

The existing literature does not comprehensively address how pedagogical differences between digital natives and digital migrants affect integration into AI-supported teaching processes. Furthermore, there is limited research on which support mechanisms are most efficient to enable digital migrant teachers to use AI technologies more effectively.

By analyzing the pedagogical differences between digital natives and digital immigrants through the lens of AI-based teaching strategies, this research seeks to address several key gaps in the existing literature. First, it aims to examine in detail how the pedagogical differences between digital natives and digital immigrants affect the adoption process of AI tools in educational contexts. Secondly, the study intends to identify how AI-supported teaching tools influence the pedagogical adaptation process of digital immigrant teachers, who may face more challenges in integrating modern technologies into their instructional practices. Finally, it seeks to reveal the most effective teacher training strategies that can ensure the sustainable and meaningful integration of AI tools in education. The findings of this research are expected to offer valuable insights into the ways teachers adopt AI tools within the broader field of educational technologies and to provide evidence-based guidance for shaping future educational policies.

Method

This section details the research design, participants, data collection process, and analysis methods. Using a mixed-methods research design, the study examines the adoption processes of AI-supported teaching tools by digital natives and digital immigrants with a multifaceted approach.

Research Model

In this study, mixed-methods research design was used. This method aims to provide a more comprehensive analysis of teachers' technology adaptation processes by combining both quantitative data (survey) and qualitative data (interviews and classroom observations) (Creswell & Plano Clark, 2017).

The research design is composed of two main components that complement each other to provide a comprehensive understanding of the topic. First, a descriptive research design was employed, in which a questionnaire was administered to identify the differences in AI tool usage between digital natives and digital immigrants. This quantitative approach helped to capture measurable distinctions in technological competence and frequency of AI adoption among the two groups. Secondly, an exploratory research model was utilized through semi-structured interviews and classroom observations to gain deeper insights into the challenges faced by digital immigrant teachers during the process of adopting AI tools, as well as their pedagogical adaptation experiences. This qualitative component allowed for a richer understanding of the contextual and experiential factors influencing their teaching practices. Overall, this combined model is well-suited for uncovering the pedagogical preferences of digital natives and digital immigrants, examining their AI adoption processes, and identifying the differences in their teaching strategies.

Sample and Participants

The population of this study consists of teachers working at different educational levels (primary, secondary and higher education) in Türkiye. The research aims to analyze how age and professional experience differences affect their adoption of AI-supported teaching tools.

Sample Selection and Rationale

In the sample determination process, both purposive sampling and stratified sampling methods were employed to ensure a balanced and meaningful representation of participants. Purposive sampling allowed the deliberate selection of teachers who actively use AI-supported teaching tools at varying levels, ensuring that participants possessed relevant experience with technology-enhanced education (Patton, 2002). In addition, stratified sampling was applied to categorize participants into two distinct groups based on their year of birth and professional experience: digital natives, consisting of teachers born after 1980, and digital immigrants, including those born in 1980 or earlier. This stratification made it possible to conduct a comparative analysis of how various levels of technological familiarity influence teachers' adoption and integration of AI-supported teaching tools. Overall, the combined use of these sampling methods was particularly suitable for capturing the nuanced differences between generational cohorts in their engagement with AI-based educational practices.

Sample Size and Distribution

Information about the participants is given in Table 1.

Table 1.

Participants information

Participant Group	Number of Participants (n)	Age Range	Professional Experience (Years)
Digital Natives	56	25-40	1-15
Digital Immigrants	57	41+	16+
Total	113	-	-

According to table 1 the sample size increases the reliability of the results by exceeding the threshold of 100+ participants recommended in mixed method studies (Creswell & Plano Clark, 2017; Al-Zyoud, 2020).

Data Collection Process

Three different data collection tools were used in the study: questionnaire, semi-structured interviews, and classroom observations.

Survey (Quantitative Data Collection)

Objective: To analyze the levels of use of AI-supported teaching tools, differences in pedagogical preferences and integration of AI into teaching processes.

Scale Development Process: The scale was adapted from previous studies on pedagogical adaptation of AI (Eltahir, et. Al., 2024; Chao, et. Al., 2021). Content analysis was conducted by three expert academicians for scale validity. The reliability of the scale was tested with Cronbach Alpha coefficient and calculated as $\alpha = 0.89$ (high reliability level).

The survey designed for this research aimed to collect comprehensive data on teachers' experiences and perceptions regarding the use of AI-supported teaching tools. The survey content focused on several key dimensions: the frequency of use of AI tools, the level of knowledge about AI-supported teaching tools, attitudes towards technology, and the impact of AI tools on teacher workload. These dimensions were selected to capture both the behavioral and attitudinal aspects of technology adoption among teachers.

To operationalize these variables, several sample survey questions were included. For instance, participants were asked, "How often do you use AI-based training tools?" with response options ranging from Never to Always, to measure the frequency of AI tool usage.

Another example question was, “Do you think AI tools facilitate your lecturing?” with a Likert scale ranging from Strongly disagree to Strongly agree, aimed at assessing teachers’ perceived usefulness of AI in instructional contexts. Overall, the survey sought to reveal meaningful patterns in how digital natives and digital immigrants perceive, understand, and apply AI tools in their teaching practices.

Semi-structured Interviews (Qualitative Data Collection)

The primary objective of this stage of the research was to understand how and for what purposes teachers use AI tools in their instructional practices. To achieve this, one-to-one interviews were conducted with twenty teachers, allowing for in-depth exploration of their experiences, perceptions, and motivations regarding AI integration in education. The qualitative data collected from these interviews were analyzed through thematic analysis, facilitated using NVivo 12 software, which enabled systematic coding and identification of emerging themes and patterns.

The interview protocol included several guiding questions designed to elicit detailed and reflective responses. Sample questions included: “For what purposes do you use AI tools?”, which explored the functional and pedagogical applications of AI in teaching; “What are the biggest advantages and disadvantages of AI tools in your classes?”, which aimed to capture both the perceived benefits and drawbacks; and “What are the biggest challenges you face when using AI tools?”, which sought to uncover barriers and difficulties experienced by teachers during the adoption process. Overall, the interviews provided rich qualitative insights into teachers’ real-world interactions with AI technologies, contributing to a deeper understanding of their pedagogical implications.

Classroom Observations (Qualitative Data Collection)

The objective of this phase of the research was to observe how teachers use AI tools in real classroom settings to gain firsthand insights into their practical applications and pedagogical impact. To achieve this, observations were conducted in five different classrooms, representing diverse educational contexts and teaching environments. The data collected through these classroom observations were systematically examined using the content analysis method, which allowed for the identification of recurring themes and patterns related to AI integration in teaching practices.

The observation criteria focused on three main dimensions: the role of AI tools within the teaching process, the level of student engagement and interaction during AI-supported activities, and the pedagogical compatibility of technological tools with the lesson objectives

and instructional methods. These criteria were selected to evaluate not only the functional use of AI in classrooms but also its effectiveness in enhancing learning experiences and supporting pedagogical goals. Overall, the classroom observations provided valuable empirical evidence about how AI tools are integrated into daily teaching practices and how they influence both teacher behavior and student participation.

Data Analysis

The study employed a mixed-methods analytical approach, combining both quantitative and qualitative data analysis techniques to ensure a comprehensive understanding of teachers' interactions with AI-supported teaching tools.

For the quantitative data analysis, statistical procedures were conducted using SPSS and Python. The analysis began with descriptive statistics, including the calculation of frequency, mean, and standard deviation values, to summarize participants' responses and provide an overall picture of AI tool usage patterns. Subsequently, a t-test was performed to determine whether the differences between digital natives and digital immigrants in their use of AI tools were statistically significant. In addition, a correlation analysis was conducted to explore the relationships between the extent of AI use and teachers' pedagogical preferences, shedding light on how attitudes toward technology relate to instructional behaviors. Finally, a regression analysis was applied to identify the key factors influencing the integration of AI tools in educational settings, offering insights into the predictors of successful adoption.

For the qualitative data analysis, the interview and classroom observation data were systematically examined through thematic content analysis using NVivo 12 software. This process involved coding the data, identifying recurring patterns, and grouping them into overarching themes related to teachers' experiences, challenges, and perceptions regarding AI use. Together, these analytical approaches provided a robust foundation for interpreting both the measurable trends and the nuanced, context-dependent aspects of AI integration in education.

Ethics Committee Permission Certificate

Throughout the research process, all procedures were conducted in accordance with the Declaration of Helsinki and established ethical research standards to ensure the integrity and

ethical soundness of the study. Participation was entirely voluntary, and all individuals were informed about the purpose of the research before giving their consent to take part. To protect participants' privacy, all collected data were anonymized, and strict measures were taken to maintain confidentiality at every stage of data handling and reporting. Furthermore, the research design and methodology received approval from the ethics committee of the relevant university, confirming that the study complied with institutional and international ethical guidelines for research involving human participants.

Findings

This section presents the analysis of quantitative (questionnaire), and qualitative (interview and observation) data obtained from the research. The level of adoption of AI-supported teaching tools among digital natives and digital immigrants, its impact on teaching strategies and the challenges encountered are examined.

AI Usage Differences between Digital Natives and Digital Immigrants

Usage Rates of AI Supported Teaching Tools

The survey results show that digital natives use AI-supported teaching tools more widely than digital immigrants. The χ^2 (Chi-square) test results reveal that there are statistically significant differences between the two groups in terms of the use of AI tools ($p<0.05$).

Table 2.
AI Usage Rates Among Digital Natives and Digital Immigrants

AI Tool	Digital Natives (%)	Digital Migrants (%)	χ^2 ($p<0.05$)
AI-powered content production	72%	34%	p = 0.005
Automated student assessment systems	65%	29%	p = 0.011
AI-based data analysis and learning monitoring	58%	21%	p = 0.007
Providing student feedback with AI	62%	27%	p = 0.003

The main findings of the study reveal distinct differences between digital natives and digital immigrants in their use of AI tools within educational contexts. It was found that digital natives tend to use AI-based content production and data analysis tools more frequently, reflecting their higher level of technological familiarity and confidence in integrating AI into their teaching practices. In contrast, digital immigrants were observed to be more cautious and reserved in their use of AI tools, a tendency influenced by their traditional pedagogical habits and lower levels of digital fluency. Additionally, the study highlighted that student

assessment and feedback systems supported by AI are more commonly utilized by digital natives, who leverage these tools to track progress and enhance student achievement. Overall, these findings underscore the generational divide in technology adoption and emphasize the need for targeted professional development programs to support digital immigrant teachers in adapting to AI-enhanced educational environments.

Pedagogical Effects of AI Supported Teaching Tools

Teachers' Attitudes Towards the Use of AI

According to the survey data, 82% of digital natives reported that AI-powered teaching tools made their lessons more effective, compared to only 38% of digital migrants ($p = 0.001$).

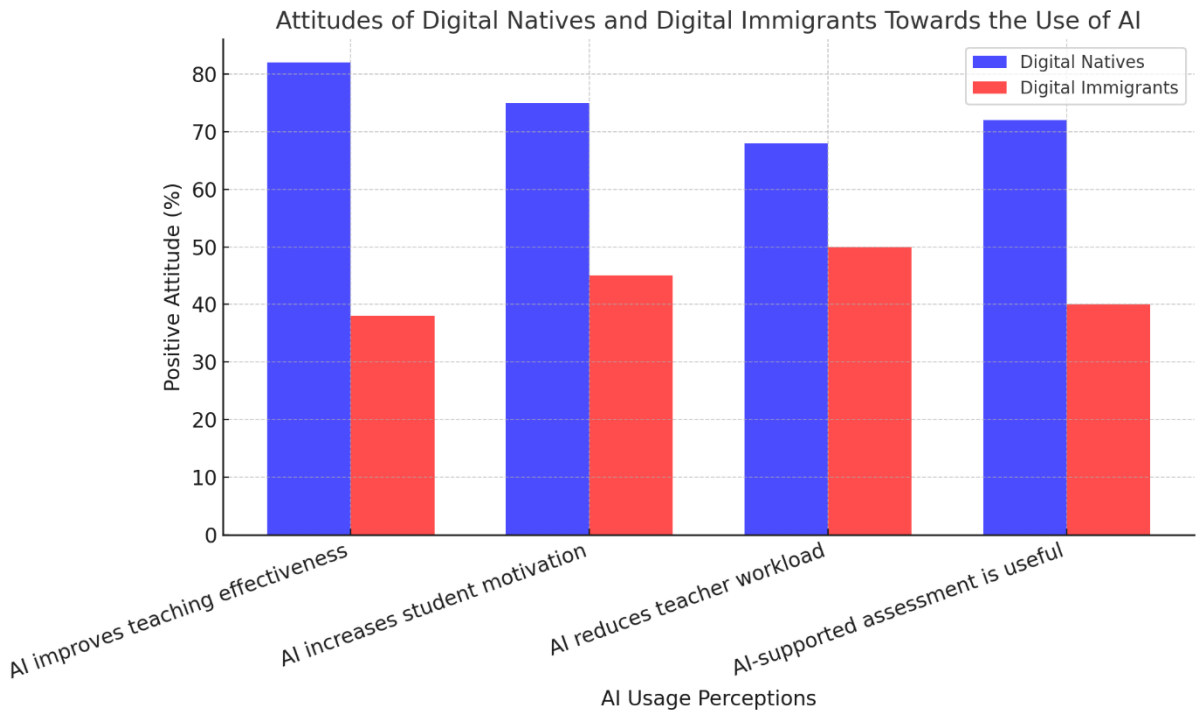

Figure 1. *Attitudes of Digital Natives and Digital Immigrants towards the Use of AI*

Figure 1 compares the percentages of teachers with positive attitudes towards the use of AI.

The findings further demonstrate notable differences in teachers' perceptions of AI tools based on their generational and pedagogical backgrounds. Digital natives believe that AI tools enhance student motivation and support individualized learning, reflecting their openness to technology-driven teaching strategies and their confidence in leveraging digital innovations to personalize instruction. In contrast, digital immigrants often struggle to adapt

to these technologies, expressing uncertainty or discomfort with integrating AI into their existing teaching practices. Moreover, the timesaving and workload-reducing benefits of AI tools are more widely recognized and accepted by digital natives, who tend to incorporate such tools more seamlessly into their daily routines. These results highlight a clear generational gap in both the perception and utilization of AI technologies in education, emphasizing the importance of tailored training initiatives to help digital immigrant teachers build confidence and competence in AI-supported pedagogical approaches.

Interview Results: Attitudinal Differences between Digital Natives and Immigrants

Semi-structured interviews revealed differences in the motivations and pedagogical approaches of digital natives and migrants in using AI tools.

Table 3.

Opinions of Digital Natives and Digital Immigrants on the Use of AI

Opinion Theme	Digital Natives Quotes	Digital Immigrants Quotes
Use of AI-supported teaching materials	💬 *"I prepare adaptive content according to students' needs."* (Age 34)	💬 *"Using digital materials in the classroom can sometimes be complicated."* (Age 52)
Impact on teacher workload	💬 *"I save time because I can do student evaluations automatically."* (Age 29)	💬 *"I need more time to learn how AI tools work."* (age 48)
Technical support needs	💬 *"I usually learn AI tools using online tutorials."* (37 years)	💬 *"I could adapt more easily if there was technical support at school."* (55 years old)

The study's findings reveal contrasting perspectives between digital natives and digital immigrants regarding the pedagogical role of AI in education. Digital natives perceive AI-powered teaching tools as highly effective for promoting student-centered pedagogical transformation, recognizing their potential to foster active learning, personalization, and greater student autonomy. In contrast, digital immigrants express concern that the increasing use of AI may weaken the traditional teacher–student relationship, fearing that technology could reduce the human interaction and emotional connection essential to effective teaching. Furthermore, the research identifies a lack of technical knowledge as one of the most significant barriers preventing digital immigrants from adopting AI tools, limiting

their ability to fully engage with emerging educational technologies. These insights underscore the need for targeted professional development and digital literacy programs to bridge the technological and pedagogical gap between generations of educators.

Challenges in the Use of AI

The challenges faced by teachers with artificial intelligence are given in table 4.

Table 4.
Challenges Faced by Teachers Using AI

Difficulty Type	Digital Natives (%)	Digital Migrants (%)
Lack of technical knowledge	28%	76%
Pedagogical adaptation of AI tools	42%	69%
Data privacy and security concerns	35%	58%
Lack of time to learn AI tools	31%	65%

Based on the findings of the study, several solutions are proposed to enhance the effective and ethical integration of AI tools in education. First, comprehensive teacher training programs should be developed as part of continuous professional development initiatives, enabling educators to acquire the necessary skills and pedagogical knowledge to use AI tools effectively in their classrooms. Such programs would be especially beneficial for digital immigrant teachers, helping them overcome technological barriers and adapt to AI-driven teaching environments.

Secondly, the establishment of technical support mechanisms within schools is essential. These support units should provide ongoing guidance and assistance to teachers in the use of AI-based instructional tools, troubleshooting technical issues, and offering pedagogical advice on integrating AI into various subjects and teaching methods.

Finally, there is a strong need to develop and implement ethical standards at both national and international levels to ensure data privacy, security, and responsible AI use in education. Establishing such frameworks would help protect student data, build trust in AI systems, and promote the sustainable and equitable adoption of AI technologies across educational institutions.

The main conclusions of the study highlight significant generational and pedagogical differences in the adoption and use of AI-supported teaching tools. It was found that digital natives make more extensive and versatile use of AI technologies in their teaching practices,

reflecting their higher level of digital literacy and confidence in applying new tools. In contrast, digital immigrants remain more reliant on traditional instructional methods and demonstrate a greater need for support and training during the process of adapting to technology-driven educational environments.

The study also concludes that the effective use of AI tools contributes positively to student achievement by enhancing learning outcomes and enabling individualized, student-centered instruction. However, several key challenges were identified, including insufficient technical knowledge, concerns about data privacy, and difficulties with time management, all of which hinder teachers' ability to fully integrate AI into their pedagogical practices.

Overall, these findings underscore the importance of developing systematic teacher education programs aimed at strengthening educators' competencies in AI use. Such programs should focus on both the technical and ethical dimensions of AI integration, ensuring that teachers across generations are equipped to use these technologies effectively and responsibly to enhance teaching and learning.

Discussion

In this chapter, the findings of the study are evaluated in comparison with the existing literature and discussed in the context of the impact of artificial intelligence (AI) assisted teaching tools, pedagogical differences between digital natives and digital immigrants, and challenges faced by teachers. The implications of the research findings for educational policies and teacher education are also discussed.

Pedagogical Differences between Digital Natives and Digital Immigrants

The findings of this study suggest that digital natives adopt AI-supported teaching tools faster and are more prone to technology integration compared to digital immigrants. This is consistent with Prensky's (2001) theory emphasizing the cognitive and pedagogical differences between digital natives and immigrants.

The featured findings of the study emphasize significant generational distinctions in the adoption and use of AI-supported teaching methods. Digital natives are more inclined to employ AI-based approaches, such as individualized learning, data-driven feedback mechanisms, and interactive learning environments, demonstrating a higher level of comfort

with technology-enhanced instruction. In contrast, digital immigrants tend to adhere more closely to traditional teaching techniques and often encounter greater challenges in integrating technology into their pedagogical practices.

These results are consistent with the findings of Flynn (2021), who highlights that digital immigrants often experience cognitive load associated with technology use, making it more difficult for them to adapt to digital tools. Flynn further suggests that this group requires additional guidance and structured support programs to effectively integrate AI tools into teaching. However, as noted by Margaryan & Littlejohn (2008), the assumption that digital natives are inherently skilled in technology may be overstated. Their research indicates that digital natives often use only a limited range of digital platforms effectively, implying that they too would benefit from pedagogical training and support to enhance their technological competence in educational contexts.

In conclusion, for AI integration in education to be truly effective, it is essential to develop technology-supported teaching strategies tailored to digital natives, while simultaneously providing practical training and ongoing guidance for digital immigrant teachers. Such a dual approach would ensure equitable technological adaptation across generations and foster a more inclusive, AI-enhanced educational environment.

The Effect of AI Tools on Teaching Strategies

The research findings show that AI-supported teaching tools change teachers' pedagogical approaches and play a key role in improving student achievement.

The study highlights several key pedagogical contributions of AI tools to modern educational practices. One of the most significant benefits is individualized learning, as AI systems can adapt content to suit students' individual levels, needs, and learning paces (Chao, et. al., 2021). This personalization enhances student engagement and supports differentiated instruction. Another major contribution lies in feedback mechanisms—AI tools enable teachers to provide automatic and immediate feedback, which helps students identify their mistakes and improve their learning outcomes more efficiently (Eltahir, et. al., 2024). Additionally, AI-supported testing and assessment systems play a key role in reducing teacher workload, allowing educators to save time and focus more on instructional design and student interaction.

However, despite these advantages, certain concerns persist. Some teachers worry that

AI systems may limit pedagogical flexibility, constraining the creative and adaptive aspects of teaching (Motorina, et. al., 2025). Moreover, the current generation of AI-powered tools lacks a clear framework for fostering students' original and critical thinking skills, which are essential for holistic education.

In conclusion, while AI-powered tools offer significant advantages in terms of personalizing learning and reducing teachers' workload, their use must be balanced with pedagogical flexibility and designed to support students' critical and creative thinking processes. This balance is crucial for ensuring that AI serves as a complement to, rather than a replacement for, the human elements of teaching and learning.

Challenges in the Use of AI and Solution Suggestions

Teachers encounter several significant challenges when integrating AI tools into their teaching practices, primarily related to technical knowledge, data privacy, and pedagogical compatibility. One major issue is the lack of technical knowledge, particularly among digital immigrant teachers, who often require additional training and guidance to effectively use AI-based educational technologies (Pedro, et. al., 2019). Another pressing concern involves data privacy, as there is often insufficient transparency regarding how AI systems collect, store, and process student data, raising ethical and legal questions about data protection (Bennis, 2023). In addition, teachers frequently face time management challenges, such as learning to use new AI tools and integrating them meaningfully into classroom instruction can be a time-intensive process that competes with other professional responsibilities.

To address these issues, several solution strategies are proposed. First, teacher training programs should be expanded to include practical workshops and continuous professional development opportunities, equipping teachers with both the technical and pedagogical competencies required for AI integration. Second, clear and enforceable security policies must be established to ensure data privacy and ethical use of AI tools in education. Third, blended learning models should be promoted, positioning AI systems as supportive tools that enhance rather than replace the teacher–student interaction central to effective pedagogy.

In conclusion, for AI tools to be used effectively and sustainably in education, it is essential to invest in ongoing professional development programs that strengthen teachers' technical and pedagogical skills. Such initiatives will not only empower educators to navigate

the challenges of AI integration but also ensure that technology serves to enhance, rather than hinder, the quality of teaching and learning.

AI and its Impact on Education Policies

The findings of this study indicate that specific adjustments in educational policy are necessary to ensure the successful and sustainable implementation of AI-supported teaching tools. To begin with, it is recommended that the Ministry of National Education (MoNE) establish guidance mechanisms to assist educators in effectively integrating AI-based materials into their teaching. This includes the preparation of teacher guides and instructional frameworks that clearly outline best practices for using AI tools in diverse classroom settings.

In addition, national and international collaborations should be promoted to enhance teachers' technology literacy and provide opportunities for sharing knowledge, resources, and innovative strategies for AI integration. Such partnerships can play a crucial role in reducing the digital gap between educators and ensuring equitable access to technological advancement.

Furthermore, the development of ethical standards for use of AI in education is essential. These standards should address issues of data privacy, algorithmic transparency, and responsible AI implementation, ensuring that educational technology serves both pedagogical and ethical objectives.

In conclusion, for AI-supported education policies to succeed, it is vital to implement practices that positively influence teachers' attitudes toward these technologies. Empowering teachers through training, collaboration, and ethical assurance will not only facilitate smoother AI adoption but also foster trust and long-term commitment to technology-enhanced education.

The main takeaways of the study emphasize the transformative potential of AI tools in reshaping modern educational practices while highlighting the structural and pedagogical challenges that accompany this shift. The findings demonstrate that AI technologies significantly reduce teacher workload by streamlining individualized learning and assessment processes, allowing educators to devote more time to instructional design and student engagement. However, the research also underscores that digital immigrant teachers require greater support during the process of AI adoption, particularly in terms of

technical training and confidence building.

Moreover, the study identifies teacher training programs and ethical regulations as crucial components for ensuring the widespread and responsible use of AI in education. Without adequate professional development and clear ethical guidelines, the integration of AI may remain uneven and inconsistent across institutions.

In conclusion, these results suggest that educational policies must be restructured to promote the sustainable and equitable integration of AI tools within educational systems. Such reforms should prioritize continuous teacher development, ethical governance, and systemic support mechanisms to maximize the benefits of AI in enhancing both teaching effectiveness and student learning outcomes.

Conclusion

This study aimed to evaluate the integration of artificial intelligence (AI) supported teaching tools into teachers' lecturing processes by examining the pedagogical differences between digital natives and digital immigrants. Using mixed methods research design, the study combines quantitative (survey data) and qualitative (interviews and classroom observations) analyses.

The findings show that digital natives adopt AI-based teaching strategies faster, while digital immigrants adhere more to traditional teaching methods. Lack of technical knowledge, pedagogical adaptation challenges, and perceptual barriers to the use of AI tools are among the main factors that make it difficult for digital migrants to adapt to these technologies.

The study highlights both the contributions and challenges of AI-supported teaching tools in the educational process. On the positive side, AI technologies enhance individualized learning by providing adaptive content tailored to students' levels and needs, thus making the learning process more effective. They also reduce teacher workload, particularly through AI-based assessment systems that streamline the management of exams and homework. Additionally, AI promotes interactive teaching strategies, encouraging innovative methods such as gamified learning and data-driven feedback mechanisms that enhance student engagement and motivation.

Despite these benefits, several critical challenges hinder the widespread adoption of AI tools by teachers. The most significant issue is the lack of technical knowledge, especially

among digital immigrant teachers, who require more comprehensive support and training to use AI-enabled technologies effectively. Another major concern is the pedagogical integration of AI tools, as determining which AI strategy is suitable for several types of lessons remains a complex task. Moreover, data privacy and ethical concerns persist due to uncertainties surrounding how AI systems collect, process, and manage student data, leading to hesitation among educators.

These findings clearly demonstrate that enhancing teachers' technology literacy is essential for the effective and responsible implementation of AI-supported teaching tools. It is recommended to develop practical, application-based training programs and mentoring systems to help digital immigrant teachers adapt more smoothly to this technological transformation. By addressing both the technical and ethical dimensions of AI use, such initiatives can ensure a more balanced, confident, and sustainable integration of AI into education.

Educational Policies and AI Supported Teaching Strategies

The research findings suggest that AI-supported teaching tools should be integrated more strongly into educational policies. The sustainability of AI integration in education is related to the positive impact on teachers' perspectives towards these technologies.

The study offers several recommendations for education policies aimed at promoting the effective and ethical integration of AI tools into teaching and learning processes. First, teacher training programs should be strengthened to ensure continuous professional development in the use of AI-supported instructional tools. These programs should include ongoing workshops, practical training, and mentoring systems, particularly designed to support digital migrant teachers, helping them build confidence and competence in using AI technologies.

Secondly, it is crucial to establish national standards for the ethical and safe use of AI in education. Such standards should prioritize student data protection, transparency in AI operations, and the development of AI-based educational materials that align with ethical and pedagogical principles. Ensuring accountability and trust in AI systems will enhance teachers' willingness to integrate these tools into their classrooms.

Lastly, technology leader teachers should be identified and trained, especially among digital natives who possess advanced technological skills. These teachers can then serve as

mentors or facilitators, guiding their colleagues in implementing AI-based teaching practices effectively and confidently.

In conclusion, the successful implementation of AI tools in education systems requires supportive policies and practices that positively influence teachers' attitudes toward technology. By combining continuous training, ethical governance, and peer-led mentoring, educational institutions can create a sustainable framework for the meaningful integration of AI in teaching and learning.

The Future of AI Assisted Instruction: The Role of Artificial Intelligence in Education

The findings of the study indicate that AI technologies will play an increasingly vital role in the future of education, serving as essential tools to support and enhance teachers' pedagogical functions. Several key predictions emerge from this perspective.

First, AI-powered teacher assistants are expected to become more widespread, providing substantial support in lesson planning, assessment, and the creation of individualized learning environments. These intelligent systems will enable teachers to manage their workloads more efficiently and focus on higher-order pedagogical activities such as mentoring, creativity, and student engagement.

Second, the importance of hybrid educational models will continue to grow. Blended learning frameworks that merge traditional teaching methods with AI-supported instructional strategies will become increasingly common, offering flexible, personalized, and data-informed learning experiences that cater to diverse student needs.

Third, the AI literacy of teachers will emerge as a critical professional skill. Educators will need to develop competencies in AI data analytics and interpretation to effectively monitor student progress, make data-driven pedagogical decisions, and adapt instruction accordingly.

In this context, it is essential to revise teacher training curricula and actively support AI-oriented pedagogical transformation processes. By equipping teachers with the necessary technical, analytical, and ethical competencies, education systems can be better prepared for the inevitable integration of AI technologies—ensuring that innovation enhances, rather than replaces, the human elements of teaching and learning.

e-ISSN: 3023-8374 © 2025 International Society that Learn Journal

The main takeaways of the study highlight both the transformative potential of AI tools in education and the critical need for systemic support to ensure their effective implementation. The findings confirm that AI technologies significantly reduce teacher workload by streamlining individualized learning and assessment processes, allowing educators to allocate more time to creative and interactive aspects of teaching. However, digital immigrant teachers continue to require greater support in adapting to AI-based instructional environments, reflecting persistent generational and technological divides in education.

Furthermore, the study underscores the importance of teacher training programs and ethical regulations as essential prerequisites for the widespread and responsible adoption of AI in educational settings. To complement these efforts, technical support structures and guidance mechanisms should be established within schools to help teachers use AI tools more effectively and confidently. Overall, by addressing the pedagogical differences between digital natives and digital immigrants through the lens of AI-based teaching strategies, this research emphasizes the necessity of restructuring educational policies in alignment with the evolving dynamics of AI-driven transformation.

Looking ahead, several directions are proposed for future research. First, longitudinal studies should be conducted to examine the long-term impacts of AI-supported teaching tools on both teaching effectiveness and student outcomes. Second, comparative studies should explore the pedagogical effects of AI technologies across different educational levels—including primary, secondary, and higher education—to better understand contextual differences in implementation. Finally, innovative training models need to be developed and tested to facilitate the technological adaptation of digital immigrant teachers, ensuring that all educators are equipped to thrive in AI-enhanced learning environments.

Recommendations

Based on the findings of the study, the following concrete recommendations were developed for teachers, educational administrators, policy makers, and researchers.

Recommendations for Teacher Education and Professional Development

For the successful integration of AI technologies in education, several strategic initiatives should be implemented to empower teachers—particularly digital migrants—and ensure equitable technological transformation.

First, special AI training programs should be developed specifically for digital migrant teachers. These should include hands-on workshops and professional development programs focusing on practical classroom applications of AI tools. Moreover, the Ministry of National Education (MoNE) and universities should collaborate to organize certification programs and seminars aimed at improving teachers' AI literacy. To further strengthen pedagogical understanding, sample course materials should be prepared to illustrate the educational benefits and classroom potential of AI-supported teaching tools.

Second, mentoring and collaboration systems must be encouraged to foster peer learning. Mentorship programs pairing digital native and digital immigrant teachers can promote knowledge exchange, while the implementation of a "Technology Leader Teacher" model would allow technologically proficient teachers to guide and support their colleagues in AI integration.

Finally, incentive mechanisms should be developed to motivate teachers to adopt AI tools more actively. This may include reward systems, recognition programs, and additional professional development opportunities for educators who effectively integrate AI into their lessons. Moreover, supportive institutional policies should be established to encourage and sustain AI-based teaching practices across schools.

In summary, by combining targeted training, mentorship, and incentive-based support, education systems can create an enabling environment that promotes the sustainable and

confident adoption of AI tools in teaching, ensuring that all teachers—regardless of digital background—are prepared for the future of AI-enhanced education.

Recommendations for Education Policies

For the effective and responsible integration of AI technologies in education, it is essential to establish national guidelines, ethical standards, and infrastructural support systems that ensure both the safe use and pedagogical effectiveness of AI tools.

First, national guidelines and standards for AI-supported teaching should be developed in collaboration with the Ministry of National Education (MoNE) and academic institutions. These bodies should issue official guidance documents outlining best practices for the use of AI-based teaching materials. Furthermore, national standards must be introduced to guarantee that teachers use AI tools ethically, transparently, and safely, while also ensuring that student assessment processes involving AI comply with international norms and regulations.

Second, the establishment of clear data privacy and ethical principles is crucial for building trust in AI technologies. National data security standards should be enacted to safeguard sensitive student information. In addition, AI-supported learning platforms must be developed within a framework that emphasizes data protection, fairness, and ethical responsibility. Both teachers and students should be educated about how AI systems collect, store, and use data, promoting digital awareness and accountability in the learning environment.

Finally, infrastructural support within schools is vital to ensure equitable access to AI-based education. Efforts should focus on expanding internet connectivity, improving access to digital devices, and providing AI-powered educational tools across all institutions.

Moreover, AI-integrated course content should be developed, and teachers should be encouraged and encouraged to incorporate such materials into their lessons.

In summary, the sustainable integration of AI in education requires a comprehensive national framework built upon ethical governance, robust infrastructure, and continuous professional development. By implementing these measures, education systems can harness AI's potential while ensuring safety, fairness, and pedagogical effectiveness for both teachers and students.

Recommendations for AI Supported Learning and Teaching

To ensure the effective and sustainable integration of artificial intelligence (AI) in education, strategic initiatives must be implemented to expand the use of AI tools, strengthen pedagogical alignment, and promote evidence-based policy development.

First, the use of AI tools in teaching processes should be expanded to enhance personalized and efficient learning experiences. AI-supported learning management systems (LMS) should be adopted to facilitate individualized learning paths tailored to students' needs and progress. Additionally, AI-enabled content creation tools should be developed and made widely accessible to empower teachers in producing dynamic, interactive, and data-informed course materials. To maintain pedagogical compatibility, these tools and materials should be regularly updated based on continuous teacher feedback, ensuring that AI resources remain relevant, effective, and responsive to classroom realities.

Second, it is essential to position AI as a supportive tool that strengthens teacher–student interaction rather than replacing it. AI technologies should be designed and implemented in ways that complement human teaching, ensuring that automation enhances — rather than diminishes — the relational and emotional aspects of education. To guide educators in this

process, official guidance documents should be developed to illustrate best practices for integrating AI tools into pedagogical processes while preserving the teacher's significant role in learning facilitation.

Finally, pilot applications for AI use in education should be encouraged to evaluate its impact across various educational levels. Pilot studies should be conducted in primary, secondary, and higher education contexts to measure the effectiveness of AI-based teaching strategies and identify best-fit models for different learning environments. Based on the outcomes of these pilot initiatives, data-driven policy recommendations should be formulated to determine how and where AI technologies can be most effectively applied within the education system.

In summary, expanding AI use in education requires a balanced, research-informed, and human-centered approach, where technological innovation supports — not replaces — pedagogical expertise, ensuring that AI contributes meaningfully to the advancement of teaching and learning.

Suggestions for Future Research

Future research directions should focus on developing a deeper and more comprehensive understanding of the long-term pedagogical, psychological, and institutional impacts of AI-supported teaching tools.

First, longitudinal studies should be conducted to examine the long-term effects of AI integration on both students and teachers. Such studies should evaluate how AI influences students' academic achievement, motivation, and learning behaviors, while also analyzing how it affects teachers' pedagogical practices and professional development over time. Comparative analyses between different cohorts, disciplines, and instructional approaches

would provide valuable insights into the sustained impact and effectiveness of AI-based teaching.

Second, there is a growing need for research exploring the pedagogical effects of AI tools across different educational levels. Detailed investigations should be carried out at the primary, secondary, and higher education levels to determine how AI can be effectively embedded into learning processes suited to each developmental stage. Understanding these contextual differences will enable the design of more targeted and age-appropriate AI integration strategies.

Third, educational models that facilitate the adaptation of digital migrant teachers to emerging technologies should be developed. These models should include AI-supported professional training programs, emphasizing hands-on learning and continuous mentoring. The effectiveness of these programs should be tested through empirical research, providing evidence-based recommendations for large-scale implementation.

Finally, further studies should be conducted to investigate the impact of AI-supported teaching tools on student achievement and motivation. Research in this area should explore how AI-driven learning environments influence students' engagement levels, intrinsic motivation, and overall academic performance.

In conclusion, expanding research in these areas will not only deepen our understanding of AI's educational potential but also guide policymakers, curriculum designers, and educators in creating evidence-based frameworks for the sustainable and equitable use of AI in education.

In line with these recommendations, concrete and strategic actions should be implemented to ensure that teachers' pedagogical approaches are effectively aligned with

technological innovation, thereby encouraging the meaningful and sustainable use of AI tools in education.

For the successful implementation of AI in educational settings, it is essential to begin with the creation of comprehensive training programs and mentoring systems designed to enhance teachers' AI literacy. These initiatives should focus not only on technical proficiency but also on pedagogical integration—helping teachers understand how AI can be used to improve instructional design, assessment, and student engagement.

Secondly, customized professional development programs should be designed to address the differing needs of digital natives and digital immigrants. While digital natives may benefit from advanced applications and innovation-oriented training, digital immigrants often require more foundational support, including step-by-step guidance and practical experience with AI-based tools. Tailoring professional development in this way will ensure equitable access to technological competence across generations of educators.

Finally, it is crucial to establish national policies and ethical frameworks governing the use of AI-supported teaching tools. These policies should set clear standards for data security, privacy protection, and ethical practices, ensuring that AI integration in education aligns with both national priorities and international norms.

Overall, by combining AI literacy initiatives, differentiated teacher development, and robust ethical governance, education systems can effectively bridge the gap between pedagogy and technology—creating a more adaptive, responsible, and future-ready teaching environment.

Conflict of Interest and Ethics Statement

The author declares no conflicts of interest. This research study is in accordance with research publication ethics. The scientific and legal responsibility of the articles published in IStL belongs to the authors.

Authorship Contribution Statement

Author 1: Research, Resources, Visualization, Software, Stylistic Analysis and Writing-original draft.

References

Al-Zyoud, H. M. M. (2020). The role of artificial intelligence in teacher professional development. Universal Journal of Educational Research, 8(11B), 6263–6272.

Bennis, M. (2023). Cyberculture in higher education: Narrowing the digital gap between Mark Prensky's "digital natives" and "digital immigrants." International Journal of Research in Humanities and Social Sciences, 10(1), 34–51.

Chagas Lopes, F., de Souza, W. G., Santana, M. B., Ferreira, R. C., Souza, M. C., Alves, W. M., & Silva, D. R. (2023). Integration of DICTs in education: The educational demand faced with the profiles of immigrants and digital natives. International Journal of Advanced Engineering Research and Science, 10(3), 45–58.

Chao, P. J., Hsu, T. H., Liu, T. P., & Cheng, Y. H. (2021). Knowledge of and competence in artificial intelligence: Perspectives of Vietnamese digital-native students. IEEE Access, 9, 75751–75760.

Creswell, J. W., & Plano Clark, V. L. (2017). Designing and conducting mixed methods research (3rd ed.). Sage Publications.

Eltahir, M. E., & Babiker, F. M. E. (2024). The influence of artificial intelligence tools on student performance in e-learning environments: Case study. Electronic Journal of E-Learning, 22(9), 91–110.

Flynn, S. (2021). Education, digital natives, and inequality. Irish Journal of Sociology, 29(2), 248–253.

Guo, R. X., Dobson, T., & Petrina, S. (2008). Digital natives, digital immigrants: An analysis of age and ICT competency in teacher education. Journal of Educational Computing Research, 38(3), 235–254.

Kolikant, Y. B. D. (2010). Digital natives, better learners? Students' beliefs about how the Internet influenced their ability to learn. Computers in Human Behavior, 26(6), 1384–1391. https://doi.org/10.1016/j.chb.2010.04.012

Margaryan, A., & Littlejohn, A. (2008). Are digital natives a myth or reality? Students' use of technologies for learning. Computers & Education, 56(2), 429–440. https://doi.org/10.1016/j.compedu.2010.09.004

Motorina, V., Khodorkovskyi, O., Olianich, V., Kyrychenko, O., & Yaroshevska, L. (2025). Adaptation of the educational process in Ukraine to artificial intelligence technologies: A systematic review. Periodicals of Engineering and Natural Sciences, 13(1), 55–68.

Ng, W. (2012). Can we teach digital natives' digital literacy? Computers & Education, 59(3), 1065–1078. https://doi.org/10.1016/j.compedu.2012.04.016

Patton, M. Q. (2002). Qualitative research & evaluation methods (3rd ed.). Sage Publications.

Pedro, F., Subosa, M., Rivas, A., & Valverde, P. (2019). Artificial intelligence in education: Challenges and opportunities for sustainable development. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000366994

Prensky, M. (2001). Digital natives, digital immigrants: Part 2—Do they really think differently? On the Horizon, 9(6), 1–6. https://doi.org/10.1108/10748120110424843

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education: Where are the educators? International Journal of Educational Technology in Higher Education, 16(1), 39. https://doi.org/10.1186/s41239-019-0171-0.